

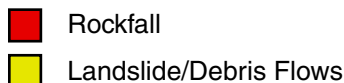
Background on WSDOT's Unstable Slope Management System

The State of Washington is responsible for 7,048 miles of highway facilities that traverse widely varying terrain and complex geologic landforms presenting slope hazards to state highways. Unstable slopes potentially affecting state highways present hazards including all sizes of landslides, rock falls, and debris flows. Failure of unstable slopes poses a risk to the traveling public and adversely affects regional commerce when highway closures result from an unstable slope condition.

Prior to 1995, unstable slopes were stabilized by contractors on WSDOT's behalf after a failure event occurred. To address unstable slope issues in a more pro-active fashion, in 1995 a preservation investment sub-program – Unstable Slopes Preservation Sub-program (P3) was established to institute a regularized program for stabilizing unstable slopes statewide. The funding level for this program was established at \$300 million dollars over ten bienniums. Historically, however, this funding level (\$30 million per biennium) has never been reached and the 2005-07 biennium is currently only funded at approximately \$18 million. To assist in the programming process WSDOT developed the Unstable Slope Management System (USMS). The management system was designed to support the priority programming of specific sites in the Unstable Slopes Preservation Sub-program (P3) goals:

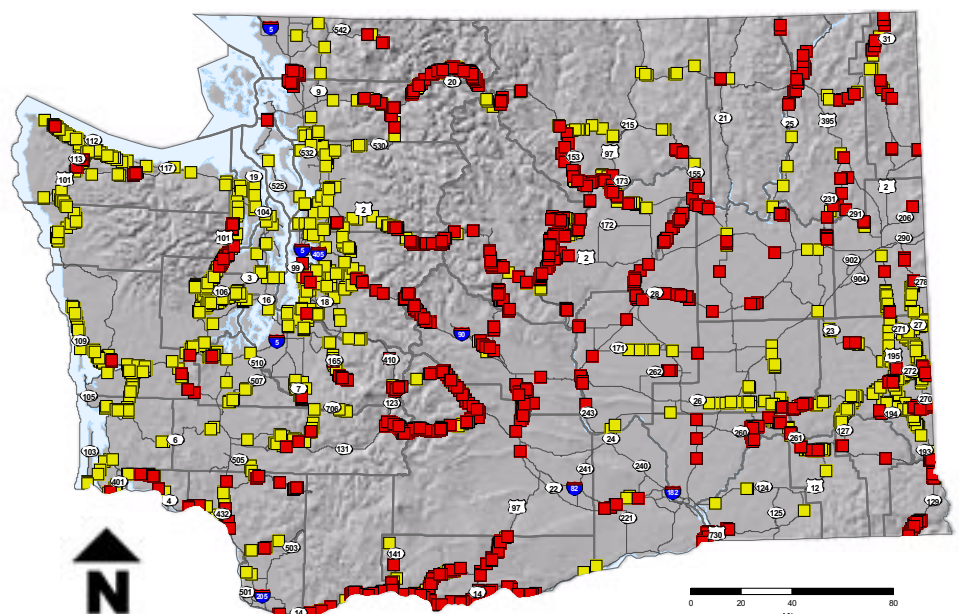
- Evaluate all known unstable slopes along WSDOT's state highway system utilizing a numerical rating system suited to both soil and rock instabilities. The rating system consists of a matrix with eleven categories, which measure potential impacts and risk factors to the highway facility if a slope was to fail. Each category is rated and the sum of the rating categories provides a total numerical rating from 33 to 891. The higher the rating, the higher the overall slope's risk and potential impact slope failure could have on the

Figure 1.1
Unstable Slopes
along State Routes in
Washington State



Source: Unstable Slope Management System (USMS)

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highway. However, the rating system does not and cannot provide a precise prediction of whether a particular slope will fail, or when it will do so.

- Provide for an unstable slope ranking strategy. The numerical rating in conjunction with the highway functional class establishes the highest need for mitigation in the unstable slope inventory, which contains in excess of 2,500 slopes. Figure 1.1 provides the location of the known unstable slopes along WSDOT's highway system.
- Provide for early development of unstable slope mitigation scoping, conceptual designs, and cost estimates that are used for cost-benefit analysis. This part of the process provides the geotechnical component to the programming cycle. Geotechnical specialists provide a description of the slope stability problem, and develop conceptual slope mitigation designs and cost estimates. A simple benefit-cost analysis compares the costs of a 24 hour traffic delay and the maintenance costs over twenty years against the projected expense to mitigate the slope hazard.
- Prioritize the design and mitigation of unstable slope projects, statewide, based on understanding of projected benefit and in conjunction with other factors such as the desirability of grouping projects in ways that increase overall program cost-effectiveness. Currently, WSDOT prioritizes and programs for mitigation only those unstable slopes that have a numerical rating of 350 or greater along interstate, principle arterials, and other highway facilities that have traffic volumes of 5,000 vehicles a day or greater, and have a benefit-cost ratio of 1.0 or greater.

As part of WSDOT's unstable slope program, ongoing slope assessment/review, project scoping, and project cost estimating are conducted every bien-nium. This work is performed by geotechnical consultants and WSDOT staff that have expertise in slope stability problems. The work entails a check of the numerical rating for each slope being evaluated, the development of a detailed description of the slope instability/failure mechanisms, a conceptual stabilization design with estimated quantities, and a cost estimate to mitigate the slope. In addition, WSDOT has conducted focused corridor studies of problematic unstable slope areas. Those include US 12 along White Pass between milepost 136 and milepost 166, and SR 14 between milepost 10 and milepost 125 through the Columbia River Gorge Scenic Area. To date, 433 slopes have been evaluated in these unstable slope reviews.

Figure 1.2

Mitigated Slopes along State Routes in Washington State

- Mitigated Rockfall
- Mitigated Landslide/Debris Flows

Source: Unstable Slope Management System (USMS)

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